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American Woods October 1945

American Beech

Forest Service
U. S. DEPARTMENT OF AGRICULTURE

AMERICAN BEECH

(*Fagus grandifolia*)

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American beech, commonly called "beech," grows principally in the Northeastern States and Lake States. Its range extends from southeastern Canada to the Gulf of Mexico.

Beech is a handsome tree with a distinctive, smooth, bluish-gray bark and is often planted for ornamental purposes. Trees 100 feet in height and 3 feet in diameter are not uncommon where growth conditions are favorable. The largest trees, which may reach an age of 300 years or more, are frequently hollow at the butt. The wood is heavy, hard, and strong, fairly uniform in texture, dark to light reddish brown in color, and without pronounced figure.

Beech is comparatively difficult to season on account of its large shrinkage and tendency to warp. The properties of the wood fit it for a number of special uses: Food containers, chair stock, turned goods such as small-tool handles and spools, laundry appliances, and many articles classed as woodenware and novelties. It is also used for making various wood distillation products such as charcoal, methanol (wood alcohol), and acetic acid, and for railroad ties, veneer, pulpwood, slack barrels, and fuel.

Large amounts of beech have been destroyed in clearing land for farms, and also for use as fuel. The present supply is markedly less than it was originally. There has, however, been no shrinkage in its commercial range. Beech as a rule grows slowly but can withstand shade better than most of its more rapid-growing but shorter-lived associates and, over long periods, often displaces them.

Nomenclature.—The name "American beech" distinguishes the tree from the European species. In this country "beech" is practically the only name in use. The term "red beech" or "red-heart beech" is sometimes applied to heartwood that is comparatively dark in color, and the term "white beech" or "white-heart beech" to the lighter-colored heartwood.

Distribution and growth.—Beech grows in the southeastern part of Canada and in the eastern part of the United States. In the United States, its range extends from Maine to northern Florida and westward from the Atlantic coast into Wisconsin, Missouri, and Texas. It usually grows in mixture with other species, although some pure stands of considerable extent occur in the Blue Ridge Mountains, especially in North Carolina.

Beech is a slow-growing tree. The following figures give the average size of typical beech trees grown under forest conditions in the Lake States: 20 years old—diameter 0.7 inch, height 13 feet; 50 years—diameter 3 inches, height 33 feet; 100 years—diameter 7.1 inches, height 57 feet; 200 years—diameter 15.7 inches, height 84 feet. Beech sometimes reaches a diameter of 4 feet and height of over 100 feet. The tree can endure wide extremes of climate, as indicated by its range from New Brunswick to Florida. It is less exacting in moisture and soil requirements than many hardwoods. The root system is apparently well adapted to draw moisture from a deep but only slightly moist soil. However, in common with most species, beech grows best in deep, well-drained, fertile loams mixed with sand or clay and kept porous and moist by well-decomposed humus.

The tree bears some seed in the form of small nuts every three or four years and heavy crops at longer intervals. Seed distribution is accomplished largely by rodents who bury the nuts for a future food supply. Some of the buried nuts are overlooked and, under favorable conditions, sprout and grow. Beech seedlings require warmth, humus, and shade for satisfactory growth. The tree is not aggressive in reproduction, but the seedlings are fairly hardy after they have gained a start. Sprout growth occurs, sometimes abundantly, but in the Lake States at least is ineffective as a means of reproduction.

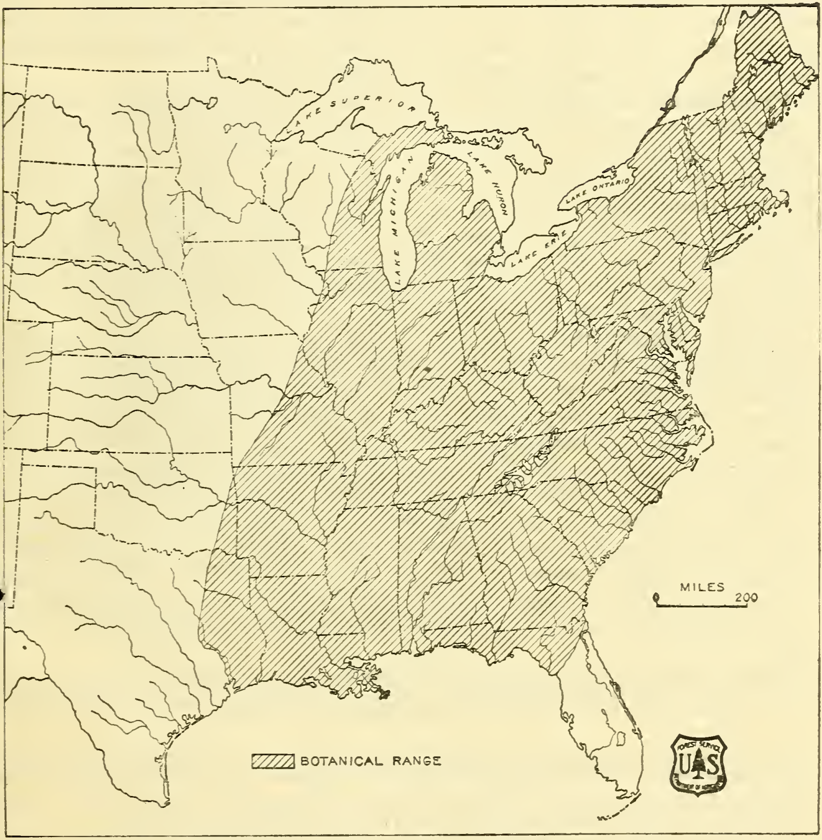

FIGURE 1.—Range of American beech (*Fagus grandifolia*).

Supply.—A rough estimate made before 1933[1] placed the stand of beech in the United States at about 8,500,000,000 board feet and located considerably over half of it in New England, New York, and Pennsylvania. A later estimate, made about 1935, gave the combined stand of birch, beech, and maple of saw-timber size as 55,178,000,000 board feet[2] and placed about 30,000,000,000 board feet in the Northeastern States, 20,000,000,000 board feet in the Lake States, and the remainder in the Central and Southern States.

A forest survey in the Lake States completed in 1937[3] showed the following approximate stands: birch, 6,500,000,000 board feet; maple, 11,800,000,000 board feet; beech, 1,500,000,000 board feet. The total stand of the three species in the Lake States was thus 19,800,000,000 board feet, of which 7.5 percent was beech. If there is the same proportion of beech in the stands of birch, beech, and maple in the Northeastern Central, and Southern States, the total stand of beech saw timber in the United States would approximate 4,125,000,000 board feet.

In addition to the beech saw timber in the Lake States, the forest survey showed 5,560,000 cords of smaller beech in Michigan and 946,667 cords in Wisconsin. Over 60 percent of the beech saw timber in the Lake States was in the portion of northern Michigan that lies between Lake Michigan and Lake Superior.

Production of lumber.—The production of beech lumber was first recorded separately in 1905,[4] when a total of 219,000,000 board feet was cut in 20 States (fig. 2). By 1909, production had risen to 511,244,000 board feet—an all-time maximum. After 1909, production declined and in 1932, a year of business depression, fell to a minimum of 42,308,000 board feet. By 1942 it had recovered to 317,384,000 board feet, cut in 29 States. This is the largest production recorded since 1920. The increased cut is doubtless due to demands brought about by the war.

The five leading States in the production of beech lumber in 1905 were Michigan, Pennsylvania, Indiana, New York, and Ohio. These States furnished over 80 percent of the cut. Michigan ranked first in the production of beech lumber from 1905 to 1924, except in 1919–21 when it was displaced by Indiana or New York. Pennsylvania took first place in 1924 and held it until 1939, except in 1931, when it was displaced by New York. Indiana was first in 1939 and West Virginia in 1940–41. The five leading States in the production of beech lumber in 1942 were Kentucky, West Virginia, Pennsylvania, Tennessee, and Ohio. They furnished over 60 percent of the cut. The average annual production of beech lumber for the 10-year period 1933–42 was 133,700,000 board feet. Production in 1943 was 318,812,000 board feet.

Distillation.—The quantity of hardwoods, principally beech, birch, and maple, used for distillation purposes in the production of charcoal, acetic acid, methanol, etc., has decreased markedly in recent years. In 1919 the Bureau of the Census reported 87 hardwood distillation plants using 1,186,000 cords of wood. In 1935 only 34 plants were reported. Consumption was not given. The average annual consumption in 1936 and 1937 was estimated at about 570,000 cords.[5] If it is assumed that about one-fifth of this was beech, the annual consumption of beech for distillation purposes was 114,000 cords, equivalent to approximately 34,200,000 board feet.[6]

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[1] Based on information collected by the Forest Service in connection with the preparation of a report, A NATIONAL PLAN FOR AMERICAN FORESTRY. Senate Doc. 12, 73d Cong., 1st Sess. 1933.

[2] UNITED STATES CONGRESS, JOINT COMMITTEE ON FORESTRY. FOREST LANDS OF THE UNITED STATES. 77th Cong., 1st sess., Senate Doc. 32, 44 pp. 1941.

[3] Conducted by the Lake States Forest Experiment Station of the U. S. Forest Service as part of a forest survey of the United States. Similar forest surveys have not yet been made in the Northeastern States, where the largest stands of beech are probably located.

[4] Bureau of the Census.

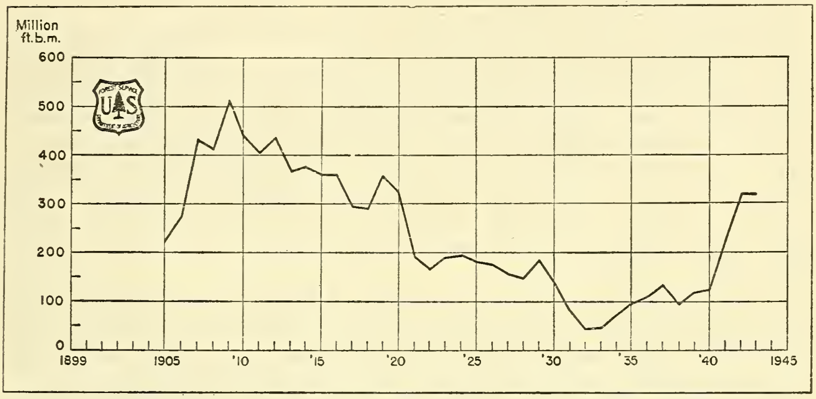

Figure 2.—Lumber production of American beech, 1905–43.

Cross ties.—Beech railroad ties may be hewed or sawed. Some are treated with a preservative to prevent decay; others are used untreated. The number of beech ties treated annually since 1914 has varied from a maximum of 4,181,000 ties in 1921 to a minimum of 426,000 ties in 1939. The average annual production of treated beech ties for the 10-year period 1933–42 was 741,000. If it is assumed that 75 percent of the total number are treated and 25 percent not treated, the annual production of beech ties in recent years would be 988,000. If it is also assumed that approximately one-half of the beech ties are hewed and one-half sawed,[7] the estimated annual production of hewed beech ties would be 494,000, equivalent to approximately 15,000,000 board feet.

Veneer.—The amount of beech used for veneer since 1924 has varied from 4,708,000 board feet, log scale, in 1925 to 17,358,000 feet, log scale, in 1929. The average annual consumption of beech veneer logs in 1929, 1931, 1935, and 1937[8] was 12,265,000 feet, log scale, equivalent to about 14,718,000 board feet.[9] More recent consumption is probably not over 10,000,000 board feet.

Pulpwood.—The consumption of beech pulpwood in 1909–11 averaged 40,000 cords per year. Since that time, beech, birch, and maple have been grouped together in pulpwood statistics.[10] During the

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[5] HAERTEL, H. M. TIMBER REQUIREMENTS OF THE HARDWOOD DISTILLATION INDUSTRY. U. S. Forest Serv. Progress Rpt. of the Forest Survey, Requirements Phase, 64 pp. 1938. [Processed.]

[6] One cord of distillation wood is considered equivalent to approximately 300 board feet.

[7] Sawed beech ties are classed as lumber and are included in the figures covering the production of lumber.

[8] Since 1937 beech has not been listed as a separate species in the veneer statistics of the Bureau of the Census.

[9] Overrun in log scale considered to be 20 percent.

[10] Compiled by the Bureau of the Census.

5-year period 1916–20 the average annual combined consumption of these species for pulpwood was about 100,000 cords. For the period 1931–40 combined, consumption varied from a minimum of 65,958 cords in 1932 to an all-time maximum of 298,895 cords in 1940, with an average of 154,932 cords per year. If it is assumed that one-sixth of this was beech, the annual consumption of beech pulpwood in recent years would amount to about 25,822 cords, equivalent to approximately 7,746,000 board feet.[11] Because of the increased war demand for pulp, it was unofficially estimated that 50,000 cords of beech pulpwood were used in 1944.

Cooperage.—Beech was formerly one of the leading woods used in the manufacture of staves and heading for slack barrels for the shipment of flour, sugar, vegetables, crackers, etc. In 1907, 125,354,000 slack staves and 17,711,000 sets of slack heading were produced.[12] By 1919, the consumption of beech for slack cooperage had fallen to less than a third of that in 1907, and by 1933, beech staves and heading were no longer listed separately in the cooperage statistics.[13] The average annual production of beech staves and heading in recent years has probably not exceeded the equivalent of 5,000,000 board feet.

A large but indeterminate quantity of beech is used annually for fuel, but only a small proportion is of saw-timber size or quality. In recent years, the average annual cut of beech of saw-timber size, for all purposes, is estimated roughly at 210,000,000 board feet.

Properties.—The heartwood of beech varies in color from reddish brown to nearly white with a reddish tinge. The sapwood is also nearly white tinged with red, and is generally from 2 to 5 inches wide in mature trees. Often it cannot be distinguished from the heartwood. The annual rings, while not conspicuous, are distinct. The pores in each annual ring decrease in size and number as seasonal growth progresses. This gives a darker appearance to the portion of the ring grown late in the season.

The wood has little figure, is comparatively close and uniform in texture, and has no characteristic taste or odor. It is heavy,[14] hard, strong, high in shock-resisting ability, and after steaming can be readily bent and held in clamps while drying so as to retain permanently the desired curvature. Beech has a very large shrinkage and requires considerable care in seasoning if checks, warping, and discoloration are to be avoided. The wood is not resistant to decay. In this respect it is classed with birch, maple, and red oak—below sweetgum and southern pine, but above basswood and cottonwood. Beech ranks high in nail-holding ability but has a tendency to split in nailing. It is difficult to work with hand tools. The wood wears well and stays smooth when subjected to friction even under water. It can be readily penetrated with a wood preservative, such as creosote, when treated by the pressure process.[15]

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[11] One cord of pulpwood is considered equivalent to approximately 300 board feet.

[12] These staves and heading together are equivalent to approximately 77,000,000 board feet. Three slack staves are equivalent to 1 board foot, and one set of heading to 2 board feet. A set of heading includes material for both ends of a barrel.

[13] Among the containers competing with wooden barrels are cotton, jute, and paper sacks; veneer packages; and cartons of fiberboard.

[14] The average weight of beech in an air-dry condition (12 percent moisture) is 45 pounds per cubic foot.

[15] In the pressure process the wood to be treated is placed on steel cars which are run into horizontal steel cylinders. The cylinders are then closed and filled with a preservative, such as creosote oil, and a heavy pressure applied which forces the oil into the wood.

Beech is comparatively difficult to manufacture into paper pulp. It is pulped almost entirely by the soda process and yields a short-fibered, easily bleached pulp that can be mixed with longer-fibered pulps to obtain paper of satisfactory strength. In fuel value beech ranks high.[16]

TABLE 1.—*Beech used in the manufacture of wooden products*

[Thousands of board feet]

Products	1912	1928	1933	1940
Agricultural implements	4, 968	540	53	213
Boot and shoe findings	445	110	417	1, 124
Boxes, baskets and crating	77, 899	44, 819	[1] 22, 503	[1] 56, 702
Boxes, cigar and tobacco	--------	--------	622	--------
Butchers' blocks	[2] 920	[2] 716	[2] 313	82
Car construction and repair	1, 874	466	75	5
Caskets and burial boxes	--------	75	--------	--------
Conduits, pumps and wood pipe	53	154	--------	--------
Dairy, poultry, and apiary supplies	(3)	1, 022	1, 371	1, 182
Dowels and skewers	[4] 1, 834	[4] 545	[4] 144	5, 405
Electrical equipment	425	56	5	--------
Fixtures	1, 109	951	5	200
Flooring	(5)	(5)	2, 244	12, 753
Furniture	48, 351	39, 000	19, 135	35, 067
Handles	20, 343	21, 323	12, 578	20, 816
Instruments, musical	4, 186	494	--------	3
Instruments, professional and scientific	1. 259	254	80	438
Ladders	(3)	(3)	13	2
Laundry appliances	9, 580	4, 226	2, 948	8, 358
Machinery	4, 218	28	3	578
Patterns and flasks	11	15	17	1
Playground equipment	3, 084	775	--------	17
Plumbers' woodwork	--------	75	580	500
Printing material	290	--------	--------	--------
Radio and phonograph cabinets	(6)	(6)	--------	--------
Refrigerators	[7] 787	[7] 26	--------	35
Rollers, shade and map	362	19	--------	181
Sash, doors, general millwork	[8] 59, 595	[8] 15, 667	[9] 337	[9] 3, 854
Sewing machines	--------	73	--------	--------
Ship and boat building	219	12	19	3
Shuttles, spools, bobbins, looms	[10] 3, 524	[10] 2, 461	[10] 1, 751	2, 249
Signs, scenery, displays	--------	--------	58	--------
Sporting and athletic goods	212	332	13	18
Surgical supplies	--------	6	--------	--------
Tanks	150	--------	--------	--------
Toys	3, 222	1, 252	1, 770	1, 679
Trunks and valises	520	--------	--------	--------
Vehicles, motor	(11)	4, 455	3, 209	720
Vehicles, nonmotor	5, 498	1, 182	--------	150
Venetian blinds	--------	--------	--------	3
Woodenware and novelties	30, 147	7, 258	5, 208	12, 402
Total	278, 203	148, 387	75, 471	[12] 164, 740

[1] The figures for 1933 and 1940 include beech used for boxes and crates by plants not classified as manufacturers of wooden products, and which were not included in 1912 and 1928. The amounts included for nonmanufacturers of wooden products are as follows: for 1933, 3,424,000 board feet, and 1940, 36,902,000 board feet.

[2] Includes skewers.

[3] Included in "Woodenware and novelties."

[4] Dowels only, skewers included in "Butchers' blocks."

[5] Included in "Sash, doors, general millwork."

[6] Included in "Furniture."

[7] Includes kitchen cabinets.

[8] Includes planing-mill products such as flooring, siding, ceiling. etc.

[9] Planing-mill products not included in 1933 and 1940 canvasses, as in 1912 and 1928, except flooring, which is listed separately.

[10] Does not include looms.

[11] Included in "Vehicles, nonmotor."

[12] This total includes 148,659,000 board feet of lumber, 14,284,000 board feet of logs and bolts, and 1,797,000 board feet in the form of veneer.

Principal uses.—Beech is used principally for lumber, distillation products, railroad ties, veneer, pulpwood, cooperage, and fuel. Beech lumber goes largely into boxes, crates, baskets, and fruit packages,[17] furniture (particularly chairs), handles, flooring, woodenware and novelties, laundry appliances, dowels and skewers, general millwork, spools, and toys. Beech is especially suitable for food containers since it does not impart taste or odor. Another use for which the wood is well fitted, because it can be satisfactorily bent after steaming, is the curved parts of chairs. The growing use of beech for small articles made with a lathe is attributable to its excellent turning properties. The hardness of the wood and its ability to take a preservative account for its large use for railroad ties.

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[16] It has about 80 percent of the fuel value of hickory.

[17] Beech baskets and fruit packages are made largely of veneer.

Beech, birch, and maple are the outstanding woods used for distillation purposes in the production of charcoal, methanol, acetate, and wood tar. Creosote made from beech tar is considered the best for medical purposes. Beech paper pulp is generally mixed with pulp from some long-fibered wood, such as spruce, and used in the manufacture of book and similar grades of paper. A limited amount of beech goes into slack barrels used largely for the shipment of vegetables and fruits.

Beechnuts are generally from one-quarter to one-half inch long. They are sweet, somewhat oily, and are occasionally gathered and sold. Beechnuts were formerly eaten in great quantities by enormous flocks of migrating, wild passenger pigeons, now extinct. In Europe oil made from beechnuts is substituted for olive oil. Beech is used as a fuel wood throughout its range.

Table 1 shows the amounts of beech used in the manufacture of wooden products in 1912, 1928, 1933, and 1940. The quantities given include beech in the form of lumber with much smaller amounts of logs and bolts, and veneer.

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U. S. GOVERNMENT PRINTING OFFICE: 1945

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